

REMARKS

Reconsideration of the application is respectfully requested in view of the above amendments and the following remarks. By way of the present amendment, claims 1, 6, 14, and 20 are amended. No claims are added or canceled. Thus, claims 1 to 7, 9 to 15, 17 to 20, and 24 are pending, with claims 1, 9, and 20 being independent claims.

A. Rejections under 35 U.S.C. § 112, Second Paragraph

Claims 1 to 7 are rejected as allegedly being indefinite. The Examiner asserts that a phrase in claim 1 is indefinite, regarding a selection of a base and alloying metal based on a characteristic of the base metal to dissolve in but not react with liquid alloying metal at an annealing temperature between the base and alloying metals' melting temperatures. The Examiner asserts that according to a binary phase diagram of Sn-Ti from Moffatts Handbook, intermetallic reactions may occur at any temperature between the melting temperatures of the pure elements. Applicant's representative discussed the Sn-Ti phase diagram and it was agreed that, according to the diagram, when Sn is only between 0 and about 15 wt.% of the composition, no reactions occur between the Sn and Ti. For this reason, claim 1 is amended to further recite that the base metal and the alloying metal are selected and quantitatively included in the powder blend according to the above characteristic.

The present invention is based in part on the ability to choose an alloying metal, instead of a carbon-based polymer, in which a base metal can dissolve and then re-solidify during a rapid prototyping method in which layers of a powder blend of the base metal and the alloying metal are iteratively exposed to an energy beam. The present amendment to claim 1 clarifies that the base and alloying metals are selected and quantitatively included in the powder blend based on this ability. For this reason, the rejections under 35 U.S.C. § 112, second paragraph should be withdrawn.

B. Rejections under 35 U.S.C. § 102(b)/103(a)

Claims 1 to 2, 9 to 10, 20, and 24 are rejected as being either anticipated by, or unpatentable over, the Elsevier Science Ltd. publication entitled, "AeroMet implementing novel Ti process" (Aeromet). These rejections are respectfully traversed.

Claim 1 is directed to method for selective sintering a powder. A powder blend is spread on a platform, the powder blend comprising a base metal of titanium or alloy thereof having a first melting temperature, and an alloying metal having a second melting temperature lower than said first melting temperature. An energy beam is then selectively focused onto the powder blend. In contrast, Aeromet discloses a process in which a base metal substrate is heated with a laser to create a molten pool, and then another powder is fed into the molten pool. Thus, Aeromet clearly fails to teach or suggest a powder blend of a base metal and an alloying metal as set forth in claims 1 to 7. A person of skill in the art would not be motivated to perform the present method, involving exposing a powder blend to a laser, when Aeromet fails to teach or suggest any such powder blend. For at least this reason, Aeromet is non-analogous art and the rejections of claims 1 to 2 should be withdrawn.

Similarly, claims 9 and 20 recite powder blends of a base metal and an alloying metal that are selected based at least on their differing melting points. As previously discussed, Aeromet discloses a process in which a second metal is introduced into a molten pool of a first metal, and no powder blend ever exists. For this reason, Aeromet fails to teach or suggest the features of claims 9 to 10, 20, and 24, and the rejections of these claims should be withdrawn.

Claims 1 to 2, 9 to 10, 20, and 24 are rejected as being unpatentable over Aeromet in view of any one of U.S. Patent No. 4,725,509 (Ryan), Welding Research Publication entitled, "Transient Liquid-Phase Bonding Using Coated Metal Powders" (Zhuang), or Metallurgical and Materials Transactions Publication entitled, "Infrared Transient-Liquid-Phase Joining of SCS-6/B21S Titanium Matrix Composite" (Blue). These rejections are respectfully traversed.

The Zhuang, Blue, and Ryan references do nothing to compensate for the previously-discussed deficiencies of Aeromet. Blue is directed to a welding method in which a filler material of Ti-15Cu-15Ni is used as a filler. However, the filler is applied to a solid base material to join two pieces of the base material. Thus, there is never a powder blend of the base material with the alloying material. Furthermore, there is no teaching or suggestion of use of such a powder blend in a rapid prototyping process in Blue or Aeromet, as recited in claims 9 and 20. Similarly, Ryan is directed to a welding method in which a filler metal that may be a Ni-Cu-Ti alloy is applied to a solid base material. Thus, Ryan fails to disclose the use of a

powder blend of base material and alloying material. Finally, Zhuang is directed to a transient phase liquid bonding process in which a powder coating of Ti-Cu-Ni is applied to a solid substrate as a melting point depressant. Again, Zhuang fails to teach or suggest a powder blend of base material with an alloying material, or a rapid prototyping method using such a powder blend as set forth in the pending claims. Since none of the prior art references, alone or in combination, provides any motivation for reaching the present invention, the rejections based on Aeromet with Ryan, Blue or Zhuang should be withdrawn.

Claims 4 to 5, 7, 12 to 13, and 15 are rejected as being unpatentable over Aeromet in view of Blue. Claims 6 and 14 are rejected as being unpatentable over Aeromet in view of Blue or Zhuang. These rejections are respectfully traversed for the same reasons set forth above regarding the independent claims.

Claim 17 is rejected as being unpatentable over Aeromet in view of Ryan or Blue or Zhuang, further in view of U.S. Patent No. 5,182,170 (Marcus). Claim 18 is rejected as being unpatentable over Aeromet in view of Ryan or Blue or Zhuang, further in view of Materials and Design Publication entitled, "Processing of titanium net shapes by SLS HIP" (Suman). These rejections are respectfully traversed at least for the same reasons previously set forth. Marcus is cited for teaching powder layers of a particular thickness, and Das is cited for post-processing steps following a liquid phase sintering and isothermal solidification method. Yet, the features of the independent claims are still not met by the cited prior art, and for this reason the rejections of claims 17 to 18 should be withdrawn.

Claims 1 and 9 are rejected as being anticipated by, or unpatentable over, Japanese Patent 06-272012 (JP-012). These rejections are respectfully traversed. As previously discussed, claim 1 is directed to method for selective sintering a powder. A powder blend is spread on a platform, the powder blend comprising a base metal of titanium or alloy thereof having a first melting temperature, and an alloying metal having a second melting temperature lower than said first melting temperature. An energy beam is then selectively focused onto the powder blend. Similarly, claims 9 and 20 recite powder blends of a base metal and an alloying metal that are selected based at least on their differing melting points. In contrast, JP-012 never teaches or suggests the use of a powder blend of a base material having a first melting point,

and an alloying material having a lower melting point. In fact, JP-012 never discloses the use of any powder blend. JP-012 merely discloses plasma spraying methods in which titanium alloys are sprayed onto a titanium base material. For at least this reason, the rejections based on JP-012 should be withdrawn.

Claims 3 and 11 are rejected as being unpatentable over JP-012 in view of Materials Science and Engineering Publication entitled, "Thermodynamic properties of Ti in Ag-Cu-Ti alloys" (Rongti). Rongti fails to compensate for the deficient teachings of JP-012. Neither reference is directed toward a rapid prototyping method, and neither involves a powder blend of a base metal and an alloying powder having a lower melting temperature than the base powder and having the previously-discussed characteristics set forth in independent claims 1 and 9.

Finally, claims 18 to 19 are rejected as being unpatentable over JP-012 in view of Zhuang. These rejections are respectfully traversed at least for the reasons previously discussed regarding JP-012 and Zhuang.

C. Conclusion

For the reasons given above, all claims now presently in the application are believed allowable and such allowance is respectfully requested. Should the Examiner have any questions or wish to further discuss this application, Applicants request that the Examiner contact the undersigned attorney at (480) 385-5060.

If for some reason Applicants have not requested a sufficient extension and/or have not paid a sufficient fee for this response and/or for the extension necessary to prevent abandonment on this application, please consider this as a request for an extension for the required time period and/or authorization to charge Deposit Account No. 50-2091 for any fee which may be due.

Respectfully submitted,
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